

## **“The VEC-CAW Model for Multivariate Stock Market Volatility”**

The VEC approach of Bollerslev, Engle and Wooldridge (1988) is the most flexible multivariate time series model for conditional covariance matrices. However, estimation of VEC models based on daily returns of risky assets is computationally challenging so that their unrestricted estimation is feasible only for settings with a quite small number of assets. In this paper we suggest a novel VEC Conditional Autoregressive Wishart (VEC-CAW) model which is based on daily realized covariance matrices computed from high-frequency intraday returns. We analyze properties of this VEC-CAW and focus on its estimation. In order to make maximum likelihood (ML) estimation of the realized VEC-CAW model computationally feasible, we derive the analytical expression for the gradient of the log-likelihood under the conditional Wishart assumption for realized covariance matrices. Constrained optimization guaranteeing stationarity and positive definiteness proceeds using Bregman divergences. Doing so we successfully conduct unrestricted ML estimation of the VEC-CAW model with reasonable computation time. Then finite sample properties of the ML estimator are investigated in a Monte Carlo study with up to 10 assets. Further, we estimate an unrestricted VEC-CAW in an empirical illustration.